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INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

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Applicant's or agent's file reference CO 0114 PCT/FoH	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA416)	
International application No. PCT/EP 03/07527	International filing date (day/month/year) 10.07.2003	Priority date (day/month/year) 10.07.2002
International Patent Classification (IPC) or both national classification and IPC C21C5/56		
Applicant CORUS TECHNOLOGY BV		

- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 6 sheets, including this cover sheet.
 - ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 5 sheets.

- This report contains indications relating to the following items:
 - I ☒ Basis of the opinion
 - II ☐ Priority
 - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
 - IV ☐ Lack of unity of invention
 - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
 - VI ☐ Certain documents cited
 - VII ☐ Certain defects in the international application
 - VIII ☐ Certain observations on the international application

Date of submission of the demand 14.01.2004	Date of completion of this report 13.12.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Ceulemans, J Telephone No. +31 70 340-3157 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/EP 03/07527**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1, 2, 4-9 as originally filed
3, 3a received on 11.10.2004 with letter of 08.10.2004

Claims, Numbers

1-23 received on 11.10.2004 with letter of 08.10.2004

Drawings, Sheets

1/5-5/5 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
☐ the language of publication of the international application (under Rule 48.3(b)).
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority in written form.
☐ furnished subsequently to this Authority in computer readable form.
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

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v

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).
(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2,9-17,19-20
	No: Claims	1,3-8,18,21-23
Inventive step (IS)	Yes: Claims	.
	No: Claims	1-23
Industrial applicability (IA)	Yes: Claims	1-23
	No: Claims	

2. Citations and explanations

see separate sheet

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Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

0. Clarity (Article 6 PCT)

0.1. The application does not meet the requirements of Article 6 PCT because claim 1 is not clear.

Claim 1 is undefined because the characterising lance arrangement is defined as functional desideratum (result to be achieved when used), rather than defining the concrete design or constructional features which are essential to achieve the desired result.

0.2. The restricted referencing in claim 19 to a vessel according to claims 13-17 is confusing and renders the definition of the subject-matter of said claim unclear (Article 6 PCT). The reasons are the following :

- claims 13-17 are dependent on claims 1-12 and therefore can not be considered independently ;
- claim 19 contains all technical features of claim 18 but is constructed as an independent claim.

1. Novelty and Inventive Step (Art.33(2) and (3) PCT)

Reference is made to the following documents:

- D1: US-A-4195985
- D2: US-A-4399983
- D3: WO-A-0022176
- D4: EP-A-0735146
- D5: US-A-5681526
- D6 : US-B-6368548

After having taken the applicant's arguments into careful consideration, the present application is not considered to meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1, 18 and 21 is not new in the sense of Article 33(2) PCT.

1.1. The above-mentioned lack of clarity notwithstanding, the subject-matter of claims 1, 18 and 21 is not new in the sense of Article 33 (2) PCT, and therefore the requirements of Article 33(1) PCT are not met.

1.1. D1 discloses explicitly the effect of sucking in exhaust gas originating from the bath

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into the free oxygen jet generated by one of the blowing lances (see column 4, lines 26-41 and column 11, lines 52-59).

D2, D3 and D4 disclose independently of each other the same effect albeit implicit.

Therefore, the subject matter of claim 1 is not novel.

1.2. D2 discloses a method of reducing iron oxide comprising the steps of (see column 1, line 59-column 2, line 4) :

- supplying iron oxide to the vessel,
- supplying carbonaceous material to reduce the iron oxide,
- supplying oxygen to the iron oxide,

while using a vessel with a cover through which at least 2 oxygen lances penetrate and which create a downward suction of exhaust gases at the vicinity of the vessel walls and upward at the centre of the vessel (implicit).

Therefore the subject matter of claims 18 and 21 is not novel.

1.3. As a consequence, the subject matter of claims 1, 18 and 21 can also not be considered as involving an inventive step in accordance with Art.33 (3) PCT.

1.4. Dependent claims 2-17 and 19, 22 and 23 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to novelty and/or inventive step, the reasons being as follows:

- the subject matter of claim 2 has been disclosed in D5, as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal design option to include these features in the vessel described in document D1 in order to solve the problem posed (Art. 33(3) PCT).
- the subject matter of claims 3-8 and 22-23 has been disclosed in D1 and can therefore not be considered as novel (Art. 33(2) PCT).
- the subject matter of claims 9-12 and 16-17 has been disclosed in D4 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal design option to include these features in the vessel described in document D1 in order to solve the problem posed (Art. 33(3) PCT).
- the subject matter of claims 13-15 and 19-20 has been disclosed in D6 as providing the same advantages as in the present application. The skilled person would therefore regard it as a normal design option to include these features in the vessel described in

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document D1 in order to solve the problem posed (Art. 33(3) PCT).

2. Industrial Applicability (Art. 33(4) PCT)

The subject-matter of the present application concerns a vessel and process which can be applied for iron and steel making.

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compared to a single jet. Each of the lances may be provided with means for emitting a plurality of jets of oxygen containing gas from its end portion.

The lances are preferably configured with at least one of the lances projecting through the roof portion of the metallurgical vessel. The roof portion of the vessel extends from the top of the sidewall. If a melting cyclone is positioned above and in open communication with the vessel then the roof portion extends from the top of the sidewall to the melting cyclone. At least one of the lances thus penetrates through part of the vessel that does not come into contact with the contents of the vessel thereby avoiding damage to the seal around the lance at the point it penetrates the vessel. Each of the lances may project through a roof portion of the metallurgical vessel.

At least one lance is preferably arranged to direct the oxygen containing gas inwards towards the central axis of the metallurgical vessel. Each of the lances may be arranged to direct the oxygen containing gas inwards towards the central axis of the metallurgical vessel. Directing the gas inwards towards the central axis of the vessel creates an area of low pressure at the lance end portion resulting in post combusted gas being entrained downward at the sidewall towards the end portion of the lance whilst an upward flow of post combusted gas is generated up through the centre of the vessel.

At least one of the lances may be inclined from the vertical under a first acute angle with its end portion inclined towards the central axis of the metallurgical vessel. Inclining a lance directs the oxygen containing gas inwards towards the central axis of the metallurgical vessel and improves the distribution of oxygen containing gas over the surface of the contents of the vessel. Each of the lances may be inclined from the vertical with its end portion inclined towards the central axis of the metallurgical vessel.

The end portion of at least one lance may also be configured to direct the oxygen containing gas towards the central axis of the metallurgical vessel under a second acute angle from the vertical which second acute is greater than the first acute angle. The greater angle from the vertical than the angle of inclination of the lance increases the upward and downward gas flow generated in the vessel. Each of the lances may be configured to direct the oxygen containing gas towards the central axis of the metallurgical vessel at a greater angle from the vertical than the angle of inclination of the lance.

The lances may be adjustable in height and therefore able to be positioned at an optimal height over the surface of the of the vessel contents when the vessel is at varying levels of fullness. The angle of inclination of the lances may also be adjustable to enable the distribution of oxygen containing gas over the surface of the contents of the vessel to be optimised.

The lance end portions may all be positioned at an equal distance from the sidewall to achieve the most effective heat distribution over the surface of the vessel contents to maximise production efficiency. Preferably three or more lances supply oxygen containing gas to the contents of the vessel to ensure optimum heat distribution and production efficiency.

Particulate material may preferably be added to the metallurgical vessel via at least one feed chute in the substantially downwardly directed flow of post-combined gases which feed

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chute is positioned at a short distance from the lances. The substantially downward gas flow in the vicinity of the sidewall thus entrains the particulate material in the form of e.g. coal fines and

~~Amended set of claims for international application no. PCT/EP03/07527~~
~~In the name of Corus Technology BV as per 7 October 2004 /~~

CLAIMS

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1. Metallurgical vessel for iron and steel making comprising a bottom portion, a sidewall and a lance arrangement of at least two lances for supplying oxygen containing gas to the interior of the vessel in operation wherein each lance comprises an end portion for emitting oxygen containing gas characterised in that the lance arrangement is configured so as to achieve in operation a substantially downwardly directed flow of post-combusted gases at the side wall of the vessel and a substantially upwardly directed flow of post-combusted gases in the centre of the vessel.
2. Metallurgical vessel according to claim 1 wherein at least one of the lances is provided with means for emitting a plurality of jets of oxygen containing gas from its end portion.
3. Metallurgical vessel according to claim 1 or 2 wherein at least one of the lances projects through a roof portion of the metallurgical vessel.
4. Metallurgical vessel according to any of the previous claims wherein at least one lance is arranged to direct the oxygen containing gas towards a central axis of the metallurgical vessel.
5. Metallurgical vessel according to claim 4 wherein at least one of the lances is inclined from the vertical under a first acute angle with its end portion inclined towards the central axis of the metallurgical vessel.
6. Metallurgical vessel according to claim 5 wherein the end portion of the lance is configured to direct the oxygen containing gas towards the central axis of the metallurgical vessel under a second acute angle from the vertical which second acute angle is greater than the first acute angle.
7. Metallurgical vessel according to any of the previous claims wherein the end portions of the lances are all of equal distance from the sidewall.
8. Metallurgical vessel according to any of the previous claims wherein the metallurgical vessel comprises three or more lances.

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9. Metallurgical vessel according to any of the previous claims wherein through at least one feed chute, particulate material is added to the vessel in the substantially downwardly directed flow of post-combusted gases.
- 5 10. Metallurgical vessel according to claim 9 wherein a plurality of feed chutes project through a roof portion of the metallurgical vessel.
11. Metallurgical vessel according to claim 9 wherein each lance has a corresponding feed chute.
- 10 12. Metallurgical vessel according to claim 11 wherein each feed chute is positioned between the lance and the sidewall of the metallurgical vessel in a radial direction.
13. Metallurgical vessel according to any of the preceding claims wherein the sidewall comprises a lower portion for accommodating a molten metal bath and a slag layer and an upper portion for accommodating a slag layer and wherein the at least two lances for supplying oxygen containing gas to the upper portion of the vessel project into the upper portion of the vessel and wherein a plurality of tuyeres for supplying gas and/or liquid and/or solids and/or plasma into the slag layer in the lower portion of the vessel are arranged around the circumference of the lower portion of the vessel.
- 15 20 14. Metallurgical vessel according to claim 13 wherein the diameter of the lower portion of the vessel is smaller than that of the upper portion.
- 25 15. Metallurgical vessel according to claims 13 or 14 characterised in that the tuyeres comprise oxy-fuel burners.
16. Metallurgical vessel according to any one of claims 1 to 15 comprising a melting cyclone positioned above and in open connection with the metallurgical vessel.
- 30 17. Metallurgical vessel according to claim 16 wherein the lances are positioned to avoid contact with molten material passing downwards from the melting cyclone to the metallurgical vessel.
- 35 18. Method of reducing iron oxides into iron using a metallurgical vessel in accordance with any one of claims 1-12 comprising the steps of supplying iron oxides to the vessel and reducing the iron oxides by supplying carbonaceous material to the vessel and supplying oxygen containing gas to the iron oxides via the lances.

19. Method of reducing iron oxide to iron using a metallurgical vessel in accordance with any one of claims 13-17, comprising the steps of supplying iron oxide to the vessel, supplying oxygen containing gas to the upper portion of the metallurgical vessel via the lances, supplying carbonaceous material to the iron oxide and supplying gas and/or liquid and/or solids and/or plasma into the slag layer in the lower portion of the vessel via the plurality of tuyeres.
20. Method of reducing iron oxide according to claim 19 characterised in that the tuyeres comprise oxy fuel burners acting as a direct heat source in the slag layer in the lower portion of the metallurgical vessel.
21. Method of iron making using a metallurgical vessel in accordance with any of claims 1-17, comprising the steps of:
- conveying iron oxide or pre-reduced iron oxide into the metallurgical vessel
 - supplying oxygen containing gas to the metallurgical vessel via a lance arrangement of at least two lances configured so as to achieve in operation a substantially downwardly directed flow of post-combusted gases at the side wall of the vessel and a substantially upwardly directed flow of post-combusted gases in the centre of the vessel,
 - supplying carbonaceous material to the vessel.
22. Method according to claim 21 comprising the steps of:
- conveying iron-oxide containing material into a melting cyclone,
 - pre-reducing said iron-oxide containing material by means of reducing post combusted gases originating from the metallurgical vessel,
 - at least partly melting the iron-oxide containing material in the melting cyclone by supplying oxygen containing gas to the melting cyclone and effecting a further post combustion in said reducing post combusted gases,
 - permitting the pre-reduced and at least partly melted iron-oxide containing material to pass downwardly from said melting cyclone into the metallurgical vessel in which final reduction takes place and
 - effecting the final reduction in the metallurgical vessel in a slag layer by supplying oxygen containing gas to the metallurgical vessel, via the lances, and supplying coal to the metallurgical vessel and thereby forming a reducing gas and effecting at least partial post combustion in said reducing gas in said metallurgical vessel by means of said oxygen containing gas supplied thereto.
23. Method of iron making according to claim 21 or 22 comprising the step of:
- supplying through tuyeres gas and/or liquid and/or solids and/or plasma into a slag layer in a lower portion of the vessel.